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A STUDY OF PUBLIC WORKS MAKE OR BUY DECISIONS

DAVID R. BIRD

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David R. Bird

A STUDY OF PUBLIC WORKS

MAKE OR BUY DECISIONS

by

David R. Bird
Commander, Civil Engineer Corps
United States Navy

Submitted in partial fulfillment of
the requirements for the degree of

MASTER OF SCIENCE
IN
MANAGEMENT

United States Naval Postgraduate School
Monterey, California

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the research requirements for the degree of

MASTER OF SCIENCE

IN

MANAGEMENT

from the

United States Naval Postgraduate School

ABSTRACT

The question invariably arises in Navy public works organizations whether to fabricate or purchase certain material components utilized in station maintenance work. Applicable cost concepts for decision purposes are discussed and the literature on the subject of make or buy is reviewed. Factors which influence make-or-buy decisions in public works activities of the Naval Material Support Establishment, as obtained by a survey study, are presented and critically analyzed.

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CHAPTER I

THE PROBLEM OF MAKE OR BUY IN PUBLIC WORKS ORGANIZATIONS

> Behind each purchase order . . . is a decision to buy and not to make; and behind each production order is a decision to make and not to buy.[1]

It is axiomatic in public works management that, if efficient utilization of personnel and staffing stability are to be achieved, transitory workloads are best accomplished under contract. Therefore significant non-recurring work; such as new construction, alterations, and major repairs; are generally contracted and station force efforts are focused on the routine maintenance and service functions. A recent trend has been to secure an increasing volume of this latter category of work via contractual arrangements when it can be demonstrated that cost reductions will accrue.

But incidental to the performance of that work which is unquestionably best accommodated by station forces, the question invariably arises whether to fabricate or purchase certain material components. Despite the frequency with which alternative choices of this nature occur in public works organizations and are dealt with, consciously or unconsciously, there is little

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[1]James W. Culliton, Make or Buy (Boston: Harvard University, Graduate School of Business Administration, 1942), p.1.

in the way of official guidance to tell the public works officer how to make the choice, and there is even less dealing with the manner in which he should proceed when confronted with the alternatives. Armed Services Procurement Regulations touch upon the subject of make or buy, but from the standpoint of administering large procurement contracts wherein the prime contractor elects to make or sub-contract. This source fails to shed much light on the problem at hand. Fortunately make-or-buy alternatives have received considerable attention in the literature of the business world.

I. THE PROBLEM

Statement of the problem. It is the purpose of this study (1) to ascertain the factors influencing make-or-buy decisions involving material components used by station maintenance forces of the Naval Material Support Establishment, as revealed through a questionnaire study; and (2) coincidental thereto, to review and evaluate some current practices.

Importance of the study. The scarcity of policy direction might be interpreted as an indication that either no problem or one of no consequence exists. This is not considered to be the case. Oblique inferences suggest that the Navy Department favors a policy of buy rather than make, but desists from formalized policy direction in recognition of the multitude of variables confronting the local activity. While it is essential that the flexibility of choice be retained at the operating level if the decision-maker

is to be effective, it should also be recognized that decentralization can lead to less than optimum results. The side effects of a choice which is advantageous to one component of an entity may prove to be detrimental to another or at odds with over-all organizational objectives. Decisions which neglect such consequences are said to "sub-optimize". Investigation that high-lights relevent considerations, which might be overlooked in make-or-buy determinations, should serve to improve these decisions and lessen the chance of "sub-optimization". Hopefully this study in some measure will contribute to this goal.

II. DEFINITIONS OF TERMS USED

Make-or-buy decision. Throughout this report, the term "make-or-buy decision" shall be interpreted as meaning the choice between: (1) manufacture or fabrication by station force personnel of the public works department and (2) commercial procurement or requisitioning from standard stock. A public works department decision to have an item fabricated by an industrial department of the same or another activity on a reimbursable basis is to be regarded as a "buy" decision.

Influencing factors. All matters, whether internal or external in origin, which are evaluated in arriving at a determination to make or buy shall be interpreted as "influencing factors".

III. ASSUMPTIONS

Preparatory to undertaking this study it was hypothesized that make-or-buy decisions in public works organizations sometimes include irrelevant or exclude relevant considerations.

IV. LIMITATIONS

This study does not attempt to develop or provide a step-by-step procedure by which a decision-maker can select the alternative. Further no general conclusion will be advanced whether buying or making is better. Emphasis is upon factors, which if overlooked or improperly evaluated, may lead to incorrect decisions.

Scope of study. The investigation is confined to decisions to fabricate or purchase material components utilized on job orders accomplished by public works shops. Determinations to accomplish repair, maintenance, renovation, alteration, minor improvement or service work by contract versus station force accomplishment are excluded.

Weighing the arguments. Arguments bearing on a make-or-buy decision may run the gamut from those which are so conclusive as to dictate the decision to those which are minor and relatively unimportant. The task confronting the decision-maker is not only to insure that all the pertinent considerations have been collected but to evaluate and weigh them against

one another and in relation to the problem as a whole. Should one factor be so dominant as to dictate the decision, further analysis is superfluous.

In other cases many factors must be carefully evaluated. A consideration which is comparatively trivial in one instance may be decisive in another situation. Consequently no argument discussed in this paper should be considered in itself without relating it to all others and, in particular, the frame of reference posed by the specific case at hand.

Method of survey. The study survey was accomplished by means of a questionnaire with the attendant possibility of misinterpretation of questions and responses. Semantic differences and design deficiencies are but a few of the potential communication difficulties.

V. ORGANIZATION OF REMAINDER OF THE PAPER

The review of the literature covered in the next chapter is accomplished in two stages. Since an understanding of cost is essential prior to a discussion of alternative choice, the first section is devoted to cost concepts, while a review of make or buy literature per se is presented in the section which follows.

The mechanics of the study are dealt with in Chapter III and the results are presented in Chapter IV, where a two-section approach is again utilized. The first section presents in tabular form the statistical data gathered. Comments on some current practices are provided in the second.

A summary, conclusions, implications and recommendations are contained in the final chapter.

CHAPTER II

REVIEW OF THE LITERATURE

I. SOME NOTES ON COST

Introduction. In the broad economic sense, cost is the determinant for making or for buying. If all the variables posed by a problem of alternative choice were readily measurable in terms of dollars, the decision-maker's selection would be greatly simplified. In the conventional sense, cost dictates the decision, other things being equal.

An understanding of different cost concepts is helpful to decision-making in several ways. In gathering together the factors which bear on a choice, the chance of an oversight is reduced. In the sorting-out process, pertinent considerations are brought more sharply into focus. Finally, a grasp of relevant cost concepts may permit the quantification of some of the "other things".

Thus a review of some of the more commonly utilized classifications is appropriate; and at this point, their summarization facilitates the review of make-or-buy literature and subsequent discussions in Chapter IV.

Costs from a cost accounting system. In problems involving alternative choice, the decision-maker is primarily interested in future rather than past costs. Occasions will arise, however, when it is necessary to extract figures from the accounting system. A few words of caution are in order at the outset.

Traditionally the accounting responsibility has been to maintain and report the financial history of the organization. "Original" and verifiable costs have been required to fulfill this function, and account classifications have evolved basically along object of expenditure classification lines for ease of verification. When functional classifications have been superimposed, as with cost accounting systems, it has been necessary to assume that original outlays can be allocated among functions on some preselected basis, such as direct labor hours or square footage of floor area. But the most equitable proration bases devisable are at best somewhat arbitrary and inflexible.

In general, allocated or prorated accounting charges should be viewed with skepticism since the emphasis on overhead absorption yields misleading results for many applications. Cost accounting provides excellent mangerial control and appraisal techniques, but in order to estimate what will happen to cost, it is frequently necessary to look behind the scene of an overhead rate and analyze individually the various elements of which it is comprised.

Opportunity versus outlay costs. Outlay costs pertain to actual financial expenditures which are recorded in the accounts. The term "explicit" is sometimes used in a similar context. Opportunity costs represent the costs of an opportunity which is foregone when resources are assigned to one purpose and are not available for another. Certain intangibles, such as inconvenience, may be extremely difficult to quantify. Other opportunity costs can be readily assigned a dollar value.

Suppose, for example, that a piece of labor saving equipment is assigned to a job to replace four workers when an alternate use would have permitted a labor saving of five men. An opportunity cost equivalent to one worker is incurred. Such costs are often called "implicit" or "imputed" costs, since they are not recorded. While not a costing technique, the rate of return analysis employed by accountants to evaluate alternative investments is conceptually akin to the idea of opportunity costs.

Opportunity cost is the cost concept to use when the input resources available are limited. Its message to management is that it is dangerous to confine cost knowledge to what is being done and ignore what could be done.[1]

Economic versus accounting costs. Economic cost implies the return or value which has been foregone or sacrificed by allocating resources or productive factors to one alternative rather than another. This definition includes the values of physical resources utilized and tangible and intangible opportunity costs. Accounting costs refer to the cost figures entered in the accounts, however they may be derived. For some outlay costs, such as direct labor, accounting costs are market prices and do not differ from economic costs.[2]

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[1]Joel Dean, Managerial Economics, (Englewood Cliffs, N.J.: Prentice-Hall, Ind., 1951), p. 260.

[2]Neil W. Chamberlain, The Firm: Micro-Economic Planning and Action, (New York: McGraw-Hill Book Company, Inc., 1962), p. 145.

On the other hand there are elements of cost which are not common to both. Inputed or opportunity costs are economic costs which are not recorded and consequently are not accounting costs. Certain accounting costs, such as depreciation, are neither outlay nor economic costs.

Traceable versus common costs. Traceable costs are costs which can be readily identified with a given product, operation, or service. Costs which are not traceable are said to be common.[3] The criterion of traceability is generally employed in accounting to distinguish between direct and indirect costs. The degree of traceability will vary among costs. Some may be traceable to the final product, while it is impractical to isolate others below a division or branch level. It is not essential that a cost possess perfect traceability for this differentiation to be useful to management.

Incremental versus sunk costs. Incremental cost is similar to marginal cost. But whereas marginal cost is the additional cost of increasing output by one unit, incremental cost may be defined as the addition to total cost which results from a particular decision.[4]

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[3]Norman N. Barish, Economic Analysis for Engineering and Managerial Decision-Making, (New York: McGraw-Hill Book Company, Inc., 1962), p. 43.

[4]W. Warren Haynes and Joseph L. Massie, Management Analysis: Concepts and Cases. (Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1961) p. 281.

Incremental costs are the valid costs to be considered when the alternatives involve a choice of different levels of activity. If the alternative selected is to continue well into the future, care must be taken to insure that long-run effects are not overlooked.

Sunk costs are the costs that are not altered by the decision in question and are irrelevant. In most instances, when cost is an argument, management decisions will best be served by comparative estimates which utilize an incremental cost approach.

Incremental and sunk costs are not necessarily characterized as common, fixed, variable, outlay, or traceable costs. Opportunity costs are frequently the most significant cost element in short-run problems.[5]

Short-run versus long-run costs. This concept is concerned with the distinction to be found in cost behavior patterns. Economic theory roughly describes short-run costs as those associated with variation in the use of facilities of fixed scale. The long run implies a sufficient period for the scale of plant to be varied. For example, increased production is achieved in the short run by the application of additional direct labor and material; in the long run additional equipment, facilities and administrative staff are added.

The lesson for management is that while the variable or direct elements of cost are relevant for short-run situations, in the long run

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[5]Dean, op. cit., p. 265.

nominally fixed and indirect costs will also vary. In using incremental costs, long-run effects should be considered when alternatives involve a choice affecting future levels of activity.[6]

Escapeable versus unavoidable costs. The distinction between these costs is basically the same as that between incremental and sunk costs. Incremental and escapeable costs change with level of activity while sunk and unavoidable costs do not. Specifically the terms incremental and sunk connote comparisons involving added activity, whereas escapeable and unavoidable refer to decrements of activity. Some writers aggregate escapeable and incremental costs into the term "differential costs".[7]

In comparing most alternative choices, management is primarily concerned with the net difference between escapeable and incremental costs. To illustrate: if the choice was to buy something now being made, a comparison of the escapeable costs of making with the incremental costs of buying would reveal the costlier alternative.

Escapeability refers to the ease with which a cost may be reduced, and the term "reducible" is sometimes used in lieu of escapeable. All costs, of course, are escapeable in the long run.

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[6]Barrish, op. cit., p. 47.

[7]Robert N. Anthony, Management Accounting: Text and Cases, (Homewood, Illinois: Richard D. Irwin, Inc., 1956), p. 360.

Variable versus fixed costs. The distinction between variable and fixed costs lies in the degree to which the total changes with increases or decreases in volume. Direct labor and materials may be expected to vary proportionately with the level of output. Certain administrative expenses, on the other hand, may be substantially fixed or constant over a considerable range of activity.

In actuality many costs fall some where between variable and fixed and are sometimes referred to as semi-variable or semi-fixed. It is sufficient to say that costs often contain both variable and fixed elements. Consider the maintenance expense of a building. The maintenance of a roof is essentially a fixed cost; interior maintenance may vary with usage or the nature of occupancy.

This concept is useful in incremental analysis when concerned with forecasting the cost impact of short-run changes in volume. What is to be regarded as fixed will be influenced by management determinations of which services are "unavoidable" and which are "escapeable".

Direct versus indirect costs. Direct and indirect costs are distinguished by the manner in which they are costed. Traceable costs which are segregated and charged directly to a job, product, service, or operation are said to be direct costs. Common costs and unsegregated, traceable costs which are not directly charged are called indirect costs.[8]

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[8]Barrish, op. cit., p. 44.

When accumulated, indirect costs are subsequently allocated on a prorata basis to end products, services, or operations they are commonly referred to as burden or overhead costs.

While traceability is the primary criterion used to identify direct cost, it is frequently impractical or economically prohibitive to segregate and separately charge all traceable costs. Thus overhead may contain trace elements of direct cost. To comprehend precisely what costs are reflected in overhead, an understanding of the accounting system from which they are derived is a requisite.

Controllable versus non-controllable costs. This concept is primarily used to establish the organizational level at which a cost is controllable. Variable costs, such as direct labor, may be controllable at work center level. Division overhead, such as supervision, obviously is non-controllable at the level of a work center, while at the department level it may be viewed as controllable.

In some respects this classification is similar to the escapeable versus unavoidable concept. The essential distinction is that controllability refers to the managerial level at which it is exercised, whereas escapeability implies the ease with which a cost can be reduced. Direct material costs may be controllable by a work center from the standpoint of waste and spoilage. They are not escapeable unless a decision is made to cancel work.

Conclusion. Although not exhaustive, the foregoing classifications are sufficient to illustrate that there are different costs for different purposes. It is evident that cost is a point of view. Unvarying definitions, which are essential for determining the status and disposition of funds, are not necessarily relevant for decision-making. An approximation of cost using pertinent concepts is more valuable than a precise enumeration of irrelevant costs.

II. LITERATURE ON MAKE OR BUY

Sources. The sources searched fell into three broad categories: (1) studies that dealt exclusively with the subject of make-or-buy decisions, (2) managerial texts which devoted a section of a chapter or more to the subject or contained a make-or-buy case, and (3) articles which have appeared in business periodicals. It was determined that studies of the subject are rare; and of necessity, availability was the dominate criteria of selection. The second source was found to possess either purchasing, managerial accounting, or industrial engineering orientations. Selections were drawn from each field represented using recent publication dates as a supplemental criterion. Research of periodicals was confined to the 1954 through 1964 period.

Studies. In his classic study Culliton noted that cost, in the broad sense, was the only factor determining a make-or-buy decision, but that this criterion had practical limitations because many immeasurable elements were included.[9] Various concepts of cost in a narrower context were offered with methods to obtain them and specific examples of their calculation.[10] Other controllable factors influencing make-or-buy

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[9]James W. Culliton, Make or Buy (Boston: Harvard University, Graduate School of Business Administration, 1942), p. 7.

[10]Ibid., Chapters II and III.

decisions were categorized as quality, quantity and miscellaneous.[11] The consequences and subsidiary effects of decisions relative to the firm as a whole are examined and illustrated with various cases, and the impact of uncontrollable external forces, such as war, cyclical changes, and political conditions are explored.[12] Culliton came to the conclusion that buy was most frequently the preferable alternative. His conclusion was predicated on the observations: (1) the impossibility of buying as a make argument tended to be offered after the fact and appeared to smack of rationalization; (2) many executives failed to recognize make-or-buy problems, and executive machinery for discovering make-or-buy decisions was nonexistent; (3) firms were lax in reviewing decisions once they were made, especially those which led to the adoption of a make program; (4) claims of inability to buy required quality were often coupled with lackadaisical procurement effort; and (5) few concerns seemed to give any attention to the change in their organization caused by the addition of something new.[13]

Referring to make-or-buy decisions, Oxenfeldt and Watkins state, "Personal interviews with members of top management . . . suggest that

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[11] Ibid., Chapters IV, V, and VIII.

[12] Ibid., Chapter VI and VII. [13] Ibid., pp. 98, 99.

probably a larger proportion of these decisions turn out badly than that of any other type of business decision."[14] They are persuaded that business most often errs in the direction of make. Accordingly their study accentuates the negative factors in making.[15] It was observed that many firms placed make-or-buy decisions in a class apart from other investment criteria and failed to subject them to the scrutiny of a return on investment analysis.[16] The inspiration for the study was the hypothesis that there was a revitalization of management interest in make-or-buy decisions, attributable to merger and integration trends. Hence the exposition stressed make decisions which emerge as a consequence.[17] Oxenfeldt and Watkins contended that the consideration most frequently overlooked or improperly evaluated in a decision to adopt a make program was the element of risk. They pointed out that fluctuations in the business cycle may strand a firm with large investments in excess capacity and fixed overhead. The argument was also made that the vulnerability of the maker to technological changes favored buying. Various cases were cited to expound these points.[18] It was concluded: (1) the choice was

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[14]Alfred R. Oxenfeldt and Myron W. Watkins, Make or Buy: Factors Affecting Executive Decisions (New York: McGraw-Hill Book Company, Inc., 1956), pp. ii, iii.

[15]Ibid., pp. 13, 14.

[16]Ibid., p. 55.

[17]Ibid., pp. 16-79.

[18]Ibid., pp. 80-94.

more often dictated by general policy considerations than by careful appraisals-- firms seemed to favor either making or buying as a matter of principle; (2) some firms were preoccupied with a concern for the security of supply, to the exclusion of all other considerations; (3) calculations for make-or-buy analyses were clumsy; (4) officials neglected to take into account firms' previous experiences prior to embarking on new make-or-buy programs, and executive opinion within the firm regarding the success or failure of past programs varied widely; and (5) businesses may be wiser to rely upon competition among their suppliers than their ability to determine relative advantages of making versus buying.[19]

Books. As might be expected, the make-or-buy arguments most cogently expressed by the purchasing fraternity were usually for buying. Westing and Fine observed that quality as an argument for making was valid, at best, only in the short run. They suggested that it was more probable that either the quality specified exceeded requirements or that producers had no assured recurring demand for the quality specified. The issues, they contended, are whether the user can economically and technologically produce the desired quality, and whether the absence of

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[19] Ibid., pp. 95-99.

suppliers is not a temporary condition.[20] Quantity, they stress, is a variable; and a decision to make less than minimum order quantities was invalid, unless buying larger amounts and carrying an inventory had been explored.[21] Other factors being equal, cost considerations introduced by make decisions were enumerated as : (1) additional cost of buying, shipping, handling, and storing raw materials; and (2) added machinery and personnel training.[22] Hodges noted that the estimated costs of making were not always reliable, and that buying on the outside fixes cost.[23] Purchasing considers quality, service, and price in that order, he contended, while in making, cost is given first consideration since management assumes it will have adequate control of the other factors.[24]

Divergent viewpoints were expressed by accounting texts regarding the treatment of costs to make. The generally conservative position taken by Nickerson was that the question of cost in make-or-buy decions centered

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[20]John H. Westing and I. V. Fine, Industrial Purchasing, Buying for Industry and Institutions (New York: John Wiley and Sons, Inc., 1961), pp. 207, 208.

[21]Ibid., p. 210. [22]Ibid., p. 212.

[23]Harry G. Hodges, Procurement, the Modern Science of Purchasing (New York: Harper and Brothers Publishers, 1961), pp. 143, 144.

[24]Ibid., p. 143.

on the choice with the lowest variable cost. With respect to arguments to exclude overhead and unused capacity costs for making a new item, he stated, "If such refinements in computations are necessary . . . to justify making . . . it is probably best . . . to buy."[25] On the matter of abandoning making to buy, he recommended a comparison of only the variable costs of making with purchase costs. He added, that if buying was continued over a longer period, certain of the fixed costs may become escapeable, but such savings should not be taken into account in a short-run decision.[26] A less conservative view with respect to the treatment of overhead expense was that taken by Haseman. In the comparative analyses he illustrated, indirect overhead was specifically excluded as fixed cost when unused capacity was available. Manufacturing expense or direct overhead was assumed to be variable.[27]

Industrial engineering approaches to make or buy ranged from economic concepts to highly definitive interpretations. Matchett focused attention primarily on the investment aspects of the make-or-buy problem.

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[25]Clarence B. Nickerson, Managerial Cost Accounting and Analysis: Text, Problems, and Cases (New York: McGraw-Hill Book Company, Inc., 1962), p. 601.

[26]Ibid., p. 602.

[27]Wilber C. Haseman, Management Uses of Accounting (Boston: Allyn and Bacon, Inc., 1963), pp. 638-640.

Making ordinarily requires investment, he explained, whereas the buy decision conserves this capital but typically increases out-of-pocket costs. "The question is whether enough can be saved in the form of annual purchase costs to justify investing in productive facilities required for the company to make the item."[28] Make or buy, as discussed by Moore, had a connotation of exactness -- this order, this item -- within the context of vertical integration. In this restricted sense, security of supply, the amount of expenditure, and workload were listed as factors influencing decisions. Make-or-buy decisions can help to achieve stability of operations, he maintained, by buying during peak periods and making during slack periods. He emphasized that make-or-buy decisions were not to be viewed as permanent.[29]

Periodicals. Contributors to the business literature on the subject of make or buy reflected a cross section of interests. Included were chief executives and senior operating officials of manufacturing and industrial concerns. Comptroller and purchasing functionaries were represented and

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[28]Gerald J. Matchett, "Economic Evaluation--Make or Buy -- Buy or Lease," National Conference of the American Institute of Industrial Engineers Proceedings: May 1963, Fourteenth Yearbook of the American Institute of Industrial Engineers (Ann Arbor: Edwards Brothers, Inc., 1963), pp. 70, 71.

[29]Franklin G. Moore, Manufacturing Management (Homewood, Illinois: Richard D. Irwin, Inc., 1958), pp. 117, 118.

contributions from members of consulting firms and university staffs were in evidence. For purposes of review, several approaches were considered but abandoned in favor of a chronological discourse.

Generally, Caditz attacked the notion of making what could be bought. It was a fallacy to cost make items at less than full cost on the theory that idle capacity was being utilized, he contended, because the practice encouraged the retention of submarginal operations. He further argued that once an item is being made, it may not receive tight operational control; whereas in buying, control is exerted via competitive market forces and the scrutiny of the pricing mechanism.[30]

Increased emphasis on guaranteed annual wages and labor force stability, Higgins believed, may force a revision of make-or-buy policies to regularize employment.[31] He noted that many decisions are automatic or so minor as to be insignificant, but that top management judgement was essential when a substantial annual dollar volume or capital expenditures were involved.[32] Estimated costs of new ventures were considered as

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[30]C. C. Caditz, "Stampings - Should You Make Them or Buy Them?" The Iron Age, CLXXIV (September 23, 1954), 108.

[31]Carter C. Higgins, "Make-or-Buy Re-Examined," Harvard Business Review, XXXIII (March-April, 1955), 109.

[32]Ibid., 110.

usually understated. A middle-of-the road position was taken with respect to overhead absorption. Higgins thought that the inclusion of all overhead in costing a make item overstated cost, while the inclusion of only direct overhead or manufacturing expense understated cost. In summarization he stated, "Frequently, the difference between making and buying in overhead is not big enough to be persuasive one way or the other."[33]

In describing the approach of a small manufacturer to the make-or-buy problem one writer cited the close liaison between production and purchasing as a key factor in obtaining correct decisions.[34]

Cochran warned against the comparison of unit costs alone in arriving at a make-or-buy decision and pointed out that it is necessary to base approach on operating objectives. Unit-cost comparisons ignore the impact of an investment in machines or rearrangements, which might dwarf savings.[35] To preclude tying up facilities in making an item at the sacrifice of having to buy another which possessed a greater make potential,

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[33] Ibid., 115.

[34] Harold C. Barnett, "Make Small Company Profits Big," Purchasing, XLV (September 1, 1958), 68, 69.

[35] E. B. Cochran, "Better Make-or-Buy Decisions," Factory Management and Maintenance, CXVI (December, 1958), 40.

he emphasized that decisions must consider relationships. He recommended make-or-buy alternatives be evaluated on a return-on-investment basis and provided a number of case analyses to illustrate this approach.[36]

Levine found the literature on the subject confusing due to the failure of writers to identify what type of make-or-buy situation they were discussing.[37] Three basic make or buy situations are described: (1) when you can buy items which you can presently make, (2) when you have no capacity, and (3) you have uneconomical make facilities. In the first instance, he advocated adding any direct overhead under-absorption that would result from buying to the supplier's quote in making a cost comparison. In the second, he recommended a return-on-investment approach, and in the third a careful analysis of escapeable costs.[38] "The rule should be," he stated, "that when you have . . . capacity . . ., you practically have no choice but to produce . . ."[39]

In a subsequent article on make or buy, Higgins noted that rationality does not necessarily prevail in these decisions. Custom,

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[36]Ibid., 40-44.

[37]Norman P. Levine, "How to Know When to Make or Buy," Purchasing, XLVI (January 5, 1959), 72.

[38]Ibid., 72-74. Note that for comparative purposes, adding to a buy estimate is the equivalent of subtracting from a make estimate.

[39]Ibid., 73.

habit, and pride were cited as factors which often served as bases for determinations.[40]

An explanation somewhat different from that of either Oxenfeldt or Higgins was offered by Chapin to account for an intensification of interest in make or buy. He hypothesized that some companies, believing they had approached the limits of their markets, were integrating backward into the business of suppliers.[41] Chapin pointed out that cost analyses can be time consuming and expensive. He also noted that elaborate analyses tended to lull one into a sense of security when the most important variables taken into account are often the least subject to measurement.[42] In particular, make decisions which would involve adding facilities were considered to require scrutiny. Aspects reviewed were: (1) the loss of liquidity through investment, (2) the risks inherent in analyses of new production costs, and (3) the influence of decisions on future profits and returns on investment.[43]

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[40]Carter C. Higgins, "You Can Form Rational Make-or-Buy Decisions," American Business, XXIX (February, 1959), 36.

[41]Roy Chapin, Jr., "When Should You Make It Yourself?" Dun's Review and Modern Industry, LXXIII (May, 1959), 54.

[42]Ibid., 55.

[43]Ibid., 55ff.

Schuba, writing in the N.A.A. Bulletin, provided a broad overview of the subject.[44] Essentially, however, the concepts are a resume of Culliton's Make or Buy.

An article, appearing in one business periodical, focused attention on the essentiality of reviewing make-or-buy decisions. Weaknesses, noted by several authorities, were cited and included the improper calculation and proration of overhead cost and the failure to integrate make-or-buy policy with long range planning. Criticism, however, was leveled primarily at letting decisions stand indefinitely.[45]

In a study of relative tooling costs in the Detroit area, Paton and Dixon found that independent job shops were able to produce at significantly less cost than the captive shops of large firms, due to higher overhead costs in the latter.[46] This work also stressed that the cost of a purchased die is final when the bid is accepted, while the same cost assurance is missing when work is undertaken internally.

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[44]Kenneth F. Schuba, "Make-or-Buy Decisions -- Cost and Non-Cost Considerations," N.A.A. Bulletin, XLI (March, 1960), 53-66.

[45]"Updating Make-or-Buy," Dun's Review and Modern Industry, LXXV (June, 1960), 157.

[46]"Tooling: Do You Make or Buy?" The Iron Age, CLXXXVIII (July 13, 1961), 120 citing W. A. Paton and R. L. Dixon, Make-or-Buy Decisions in Tooling for Mass Production (Bureau of Business Research, School of Business Administration, University of Michigan).

Two common mistakes, Hackamack contended, trap most companies into incorrect make-or-buy decisions. These are: (1) the problem is viewed as so complex that it can be approached only in general "common sense" terms, or (2) the problem is oversimplified and decision is made on raw "cost" figures alone.[47] He warned against comparisons predicated on unit costs and stressed that returns on investment must be compared. A quantitative approach, utilizing check lists and ratings derived from the average of assigned weights, was illustrated.[48]

Overhead rates, normally associated with customer pricing, have no rightful place in make-or-buy decions was the view Ward expressed. He considered that the basic concept to be followed in any decision of this nature was that of out-of-pocket costs.[49]

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[47]Lawrence C. Hackamack, "Make or Buy Can Make or Break," Purchasing, LIV (April 22, 1963), 67.

[48]Ibid., 68ff.

[49]Edwin F. Ward, "Making the Proper Make-or-Buy Decision," N.A.A. Bulletin, XLV (January, 1964), 31.

CHAPTER III

THE STUDY

I. METHOD

Critical analysis was the means selected to explore the problem and facilitate the presentation of results.

II. MATERIALS

The investigation sought to determine the factors affecting and the practices followed in making the choice between make-or-buy alternatives in Navy public works organizations.

III. RESPONDENTS

The organizations contacted were the public works centers and public works departments of the Naval Material Support Establishment. Respondents from public works centers included executive officers and planning officers. Public works department respondents included public works officers, assistant public works officers, administrative assistants, and maintenance control division directors.

IV. TECHNIQUE

A questionnaire survey was utilized in conducting the study. The questionnaire employed is attached as an appendix.

V. PROCEDURES

The first step in the conduct of the study was the initiation of a search for appropriate reference material. As material was located and accumulated, it was tentatively researched for familiarization with the various factors which influence make-or-buy decisions. Particular attention was given those aspects considered to be applicable in the instance of Navy public works organizations.

Subsequently a sample questionnaire for the proposed survey study was designed and tested on student Civil Engineer Corps officers possessing a background of public works experience and the Public Works Officer of the U. S. Naval Postgraduate School. The questionnaire was then revised in light of the constructive criticisms and suggestions for improvement generated by the test. Copies of the revised questionnaire were thereafter mailed under covering letter request to all public works center commanding officers and public works officers listed in The Civil Engineer Corps Directory.

As responses were received, the data were tallied and compiled on worksheets. Comments elicited were carefully reviewed, categorized and tabulated. Concurrently the research of reference material was continued. The preparation of the report of investigation was then initiated with the objective of presenting data relative to the factors currently influencing make-or-buy decisions in public works organizations and evaluating current practices.

CHAPTER IV

RESULTS

I. DATA OBTAINED

> It is little help to stress the need for a "careful examination of all the relevant factors" before reaching a decision. That kind of advice is on a par with the . . . admonition to "be careful."[1]

Participation. Of 184 public works organization contacted, 152 responded. A negative reply given by one activity for security reasons and an incomplete and unidentifiable response from a second were excluded from the results obtained. Thus 150 positive responses were obtained from the 184 organizations polled, and participation was computed as 81.5 per cent.

Impact of policy. To a query whether or not the majority of decisions were dictated by policies or directives which prohibited shop fabrication or encouraged procurement, affirmative replies were given by 28.0 per cent of the respondents.

Dominance of influencing factors. Respondents were requested to rank in order of dominance the factors which most frequently influenced

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[1]Alfred R. Oxenfeldt and Myron W. Watkins, Make or Buy: Factors Affecting Executive Decisions (New York: McGraw-Hill Book Company, Inc., 1956), p. 13.

make decisions. The results obtained are shown by Tables I through III.

As might have been expected, "no source of supply" and "procurement lead time" were more heavily weighted by overseas than continental U. S. activities. On the other hand, continental activities assigned more import to "workload and capability" and "comparative costs" than did overseas activities.

Surprisingly, the ranking accorded "comparative costs" by Naval Industrial and modified Naval Industrial Fund accounting activities is relatively lower than that indicated by continental U. S., appropriated fund activities. Further, NIF activities attached more weight to "no source of supply" than that evidenced by overseas, appropriated fund activities.

"Quality" and "other" influencing factors were generally low ranked by all activity classifications.

Comparative cost estimates. Formal comparative cost estimates were developed by 76.7 per cent of the respondents when costs were a determining factor in make-or-buy decisions.

Additional requirements. Activities indicated that when costs were a determining factor, make decisions sometimes generated added requirements as shown by Table IV.

TABLE I

RANKING OF FACTORS INFLUENCING MAKE DECISIONS IN 89 CONTINENTAL U. S., APPROPRIATION ACCOUNTING PUBLIC WORKS ORGANIZATIONS
(Approximate percentages shown in parentheses)

Influencing factors	Rankings assigned 1	2	3	4	5	6	Totals
No source of supply	39 (44)	21 (23)	5 (6)	14 (16)	9 (10)	1 (1)	89 (100)
Workload or capability	11 (13)	14 (16)	26 (29)	20 (22)	17 (19)	1 (1)	89 (100)
Procurement lead time	14 (16)	26 (29)	16 (17)	19 (22)	12 (14)	2 (2)	89 (100)
Comparative costs	20 (22)	24 (27)	25 (28)	13 (15)	7 (8)		89 (100)
Quality	3 (3)	4 (5)	13 (15)	20 (22)	44 (49)	5 (6)	89 (100)
Other*	2 (2)		4 (5)	3 (3)		80 (90)	89 (100)
Totals	89(100)	89(100)	89(100)	89(100)	89(100)	89(100)	

*Other factors reported included safety, security, lack of material funds, availability of surplus materials, union relations, emergencies, quantity requirements, training, and unspecified.

TABLE II

RANKING OF FACTORS INFLUENCING MAKE DECISIONS IN 30 OVERSEAS (INCLUDING ALASKA AND HAWAII), APPROPRIATION ACCOUNTING PUBLIC WORKS ORGANIZATIONS

(Approximate percentages shown in parentheses)

Influencing factors	Rankings assigned 1	2	3	4	5	6	Totals
No source of supply	14 (47)	10 (33)	2 (7)	2 (7)	1 (3)	1 (3)	30 (100)
Workload or capability	1 (3)	5 (17)	11 (37)	9 (30)	4 (13)		30 (100)
Procurement lead time	13 (44)	8 (27)	4 (12)	3 (10)	2 (7)		30 (100)
Comparative costs	1 (3)	5 (17)	9 (30)	9 (30)	3 (10)	3 (10)	30 (100)
Quality		1 (3)	2 (7)	5 (16)	19 (64)	3 (10)	30 (100)
Other*	1 (3)	1 (3)	2 (7)	2 (7)	1 (3)	23 (77)	30 (100)
Totals	30(100)	30(100)	30(100)	30(100)	30(100)	30(100)	

*Other factors reported included need, emergencies, complexity, standardization, directives limiting foreign purchases, special fabrications, and unspecified.

TABLE III

RANKING OF FACTORS INFLUENCING MAKE DECISIONS IN 31 NAVAL INDUSTRIAL FUND AND MODIFIED NIF ACCOUNTING PUBLIC WORKS ORGANIZATIONS
(Approximate percentages shown in parentheses)

Influencing factors	Rankings assigned 1	2	3	4	5	6	Totals
No source of supply	17 (55)	4 (13)	3 (9)		5 (17)	2 (6)	31 (100)
Workload or capability	5 (16)	2 (6)	8 (26)	9 (30)	7 (22)		31 (100)
Procurement lead time	3 (10)	13 (43)	8 (26)	6 (18)	1 (3)		31 (100)
Comparative costs	4 (13)	6 (19)	8 (26)	8 (26)	4 (13)	1 (3)	31 (100)
Quality	1 (3)	4 (13)	3 (10)	8 (26)	14 (45)	1 (3)	31 (100)
Other*	1 (3)	2 (6)	1 (3)			27 (88)	31 (100)
Totals	31(100)	31(100)	31(100)	31(100)	31(100)	31(100)	

*Other factors reported included developmental work, restrictive regulations, quantity requirements, directives limiting foreign purchases, tradition, and unspecified.

TABLE IV

ADDITIONAL REQUIREMENTS SOMETIMES GENERATED BY MAKE DECISIONS IN 150 PUBLIC WORKS ORGANIZATIONS

(Approximate percentages shown in parentheses)

Additional requirements	89 Continental, appropriation accounting activities	30 Overseas, appropriation accounting activities	31 NIF and modified NIF accounting activities	Totals for all types of activities***
Increased equipment allowances	4 (4)	2 (7)	1 (3)	7 (5)
Shop rearrangement	1 (1)	1 (3)	3 (10)	5 (3)
Additional or special purpose tools	17 (19)	6 (20)	9 (29)	32 (21)
Other*	5 (6)	1 (3)	3 (10)	9 (6)
Totals **	27 (30)	10 (33)	16 (52)	53 (35)

*Other additional requirements reported included manpower, schedule adjustments, special materials, and transfer of personnel between work centers.

**Percentages pertain to the type activity appearing in column heading.

***Percentages pertain to all types of activities.

The high proportion of NIF and Modified NIF accounting activities indicating "additional or special purpose tools" is partly attributed to unique industrial functions performed by the public works departments of certain ordnance activities.

Inclusion of overhead. When cost was a determining factor in make-or-buy decisions, 79.3 per cent of the participants reported the inclusion of overhead cost prorations in comparative estimates. Only one out of 150 respondents indicated that fixed elements of overhead allocations were regarded as "sunk costs" and irrelevant for purposes of comparative cost estimates.

Supply support. When lead time was a deciding factor for procurable, non-standard stock items with recurring demands, respondents indicated that the absence of arrangements to stock or buy with imprest funds or blanket purchase orders generated make decisions as follows:

	Continental, appropriation accounting activities	Overseas, appropriation accounting activities	NIF and modified NIF accounting activities
No answer	5		1
Never	12	2	8
Rarely	31	11	15
Occasionally	38	13	4
Frequently	3	4	3
Totals	89	30	31

Who makes the decision. Activities were requested to specify, by organizational title, the level at which final make-or-buy determinations were generally made. The following results were obtained:

	Continental, appropriation accounting activities	Overseas appropriation accounting activities	NIF and modified NIF accounting activities
No answer	1		
Shop supervisor	1		1
Maintenance Control Director	34	10	15
Assistant Public Works Officer or Public Works Officer	42	18	10
Maintenance Control Director and Assistant Public Works Officer or Public Works Officer	8	1	5
Supply Officer and Public Works Officer	3	1	
Totals	89	30	31

A number of respondents reported that all work-authorization authority escalated, organizationally, with estimated cost. Make decisions would necessarily follow this organizational pattern, and this policy accounts for the fifth row of the above array.

Authority delegation. Authority for make-or-buy decisions was explicitly included in delegation of job order authorization authority in the case of 52 organizations, or 34.7 per cent of those participating.

Local policies. Formal or informal policies which influenced make-or-buy decisions were existent in 64 or 42.7 per cent of the organization. These policies are categorized as follows:

Policy summation	Number of organizations
Buy all standard signs	2
Buy whenever possible	20
Buy whenever less expensive or workload is prohibitive	4
Consider availability, lead time, cost, workload and capability, and quality	7
Make whenever possible	1
Consider cost and lead time	7
Do not accept requests for fabrication	5
Consider gold flow and lead time	2
Make when less than minimum order quantities are required	1
Comparisons not made; "no cost" military labor	1
Make when possible because of training and lead time	3
Make when possible due to material fund scarcity	2
Make unless clearly more economical to buy	1
Make on occasion with short-term loans of personnel from industrial department	1
Consider material fund availability and workload	1
Consider lead time and work load	1
Consider gold flow; make no standard furniture or furnishings	1
Buy when lead time is not prohibitive	3
No explanation	1
Total	64

II. A CRITICAL ANALYSIS

> It is also clear that with respect to general problems of make or buy, arguments against making are usually arguments for buying, and vice versa.[2]

Many military logistic and support decisions are essentially economic decisions in that they are concerned with the efficient utilization of resources.[3] Public works problems of choice involving alternative uses of manpower, materials and equipment are essentially resource allocation problems. The best alternative is the choice which represents the best allocation.

In theory then, the correct make-or-buy decision is the alternative of least economic cost, since least cost in this broad sense represents the allocation that produces maximum utility. The dilemma is in determining this "cost". Some of its elements are easily overlooked; others, when identified, cannot be satisfactorily stated in dollars and require generalizations.

The standard, which will be employed in the following discussions, is the economic goal of achieving the best possible utilization of resources.

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[2]James W. Culliton, Make or Buy (Boston: Harvard University, Graduate School of Business Administration, 1942), p. 5.

[3]Charles J. Hitch and Roland N. McKean, The Economics of Defense in the Nuclear Age (Cambridge: Harvard University Press, 1963), Chapter VII, "Efficiency in Military Decisions."

Overhead. The majority of public works organizations responding indicated that, when costs were a determining factor, their comparative estimates included certain prorations of overhead costs in addition to direct labor and material. Commonly these costs were allocated as a percentage of direct labor.

Employee fringe benefits, such as employer insurance contributions, may be expected to vary directly and proportionately with direct labor. However, cost accounting, and Naval Industrial Fund accounting in particular, emphasizes the recovery of "full" cost, i.e., accounting cost. Thus customer activity services are "priced" to reflect the absorption of fixed overhead. Similarly, appropriated funds administered by NIF activities are assessed a proportionate share of certain overhead expense. While these charges are valid considerations for customer decision-making, they are not always relevant in the case of non-customer work. Overhead prorations invariably contain elements of cost which are fixed in the short run.

The local make or buy decision-maker is primarily concerned with incremental and escapeable costs. Should he decide to make rather than to buy, what additional costs may he expect to incur? If he elects to buy, what costs will be avoided? In the short run only direct, variable costs may be expected to change. For the long run, as in the case of a

precedent-setting decision, other expenses and investment costs may become incremental or escapeable.

Job order estimates are generally prepared in a form which, by insertion of appropriate accounting data and authorizing signatures, are translated into production orders. Thus job order estimates are accounting cost estimates. For control purposes, this accounting compatability is as it should be. It is essential that the decision-maker recognize that estimates in this form are not always suitable for an analysis of alternative choices.

Material fund scarcity. A number of respondents reported that it was local policy to consistently make rather than buy due to the lack of availability of material funds. Such policies are precipitated as a consequence of local budget and control procedures which set aside the estimated payroll for a given-size work force and thereafter exercise a tight-fisted control over the "material money" balance. The control of labor cost becomes a matter of keeping a fixed work force productively employed.

Under such circumstances the make-or-buy alternative is negated by a dominating fiscal policy. A fallacious tendency to regard all labor costs as fixed in the long run is encouraged, and the best allocation of labor and material resources is severely handicapped. If material fund shortages persist and the overall annual budget figure is substantially correct, work force adjustments would be in order.

"Free" military labor. Comments from an activity employing military personnel in direct labor functions indicated that comparative alternative cost estimates were not developed because of "no cost" military labor. A dominant make argument under the circumstances is incorrect. While military labor cost is not an explicit outlay under locally held allotments, military pay is a very real expenditure to the Department of the Navy.

Adherence to a consistent policy of make with "no cost" military labor could result in an excessive personnel allowance in a long-run situation.

Training considerations. Several activities indicated local practice was to make rather than buy in order to facilitate military training. The public works organizations in these instances were predominately staffed with military personnel.

The training of military personnel is unquestionably a valid consideration, but that it should consistently be a conclusive reason for selecting the make alternative is suspect. Considerations range from the identification of specific assignments with the practical factor skills of the ratings involved to the broader picture of personnel rotation patterns between sea and shore duty. The latter is hardly determined at the local level.

If the value of training derived can be quantified, it should be incorporated in a comparative cost analysis along with the cost of military labor. More often training is of an intangible nature, and there is a prevalent temptation to ignore costs not borne by local funds or to seek to rationalize decisions in qualitative terms. "Military training" arguments may unwittingly be "free military labor" arguments in disguise.

Idle capacity. Collectively, respondents indicated a relatively low ranking for workload or capability as a dominant factor influencing make-or-buy decisions. When other conclusive arguments do not dictate a decision, a careful examination of capacity utilization warrants consideration.

Ideal work center loading is extremely difficult to achieve. Despite a substantial departmental backlog, intermittent slack will occur which cannot always be resolved by shifting personnel among work centers. Work force adjustments are not readily or inexpensively accomplished in the short run on other than a detail or transfer basis. Reduction in force procedures with accompanying terminal leave expense and resultant disruptions are costly. Rehiring involves a sacrifice in efficiency while new employees adjust.

Consequently in some very short-run situations, labor may be viewed as momentarily fixed. In such instances an iron-clad policy of always buy can lead to incorrect decisions. Rather it would be pertinent to consider the alternative employment value of the labor which would otherwise be diverted to fabrication.

There are two sides to every coin. Although making can be advantageous during certain slack situations, buying helps to smooth out the peaks of heightened activity.

Cost "creep". Survey responses made no reference to frequency as a factor influencing make-or-buy decisions. Make decisions, which appear quite correct when viewed individually or from a short-run perspective, can in fact be incorrect when viewed aggregately or from the standpoint of a longer interval of time.

The frequency with which a particular requirement recurs is usually relevant in decisions to make or buy. Making an item over a sustained interval may introduce cost considerations either not envisioned or necessarily pertinent for sporadic or short-run occurences.

For instance, a need may be eventually generated for additional tools or improved equipment to facilitate repeated fabrications. Nominally fixed elements of overhead expense will creep upward if a substantial volume is generated over a period of time. It is helpful to recall that in the economic sense all costs are variable in the long run.

Supply support. Long-run implications are equally relevant when considering supply support. The matter of quantity -- sufficient quantity at the right time -- must necessarily be viewed in the context of time.

The right demand rate for an item can enable procurement personnel to attract new vendors, secure lower price quotations, or arrange for

improved delivery schedules. If buy-versus-make economies offset or exceed inventory holding costs, consolidated ordering and stocking warrants consideration. These and other possibilities can alleviate excessive lead time and less than minimum order quantity problems.

When other criteria are met, stock fund availability is often constraining. The opportunity cost concept may prove helpful in these instances. For example, there may be no comparative advantage in sacrificing the present paint stock held by supply to stock an inventory of kitchen sinks. On the other hand, maintenance and operation fund investments in "bench stocks" of special material create artificial "material money" shortages.

Close liaison with supply representatives is paramount. They, too, have a resource allocation problem, and if unaware of relevant considerations, they may sub-optimize.

No source of supply. Under some circumstance, time is of the essence. In instances, such as a casualty to critical operational equipment or the breakdown of an obsolete item, make decisions may be unavoidable.

It is difficult to envision a material item for which there is actually "no source of supply" in the strictest sense. A more plausible explanation is that when time is of the essence no supplier has the item on his shelf

or no manufacturer has it in production. "No source of supply" in reality can be another way of saying that the lead time is prohibitive or it is more convenient to make.

When time is not decisive, the preparation of specifications suitable for procurement may be economically warranted for high cost items, even when infrequently required.

"No-cost" materials. In one instance it was reported that the availability of "free" material dictated make decisions. Occasionally this argument is valid, but generally it should be viewed with skepticism. Often it is the material analogy of the "free" military labor argument.

Material is truly "free" only when its usage incurs no opportunity loss. Suppose, for example, that certain salvaged or scrap material on hand is utilized to make an item, since by omitting material charges the cost of making appears less than the cost of buying. Subsequently the purchase of identical material is necessitated for other work. Was it less costly to make than to buy? Material, which has been expensed and is "free" in an accounting sense, frequently has an imputed value in the economic sense. Such opportunity costs are relevant in the decision-making process.

To view no-cost surplus materials obtained via excess listings from other governmental activities as "free", similarly, presupposes that there is no other potential user with a better application. Inefficient

utilization of such material may minimize charges against local allotments but at the net expense of government appropriations. Other relevant costs frequently overlooked in the case of excess materials are the handling and shipping expenses incurred by non-local funds.

Capital cost. While local funds absorb plant maintenance expenses, capital or plant account acquisitions for the most part are borne by other than annual maintenance and operations allotments. MCON appropriations finance the construction of new facilities, major equipment is furnished by cognizant bureaus on an allowance basis, and other minor improvements and equipment acquisitons are obtained via special allotments. On occasion this feature of Navy financial management encourages narrow perspectives and sets the stage for sub-optimal decisions.

The expense of facility alterations, special tool purchases, or equipment inventory additions directly attributable to make decisions are relevant costs, whether or not they are financed with local maintenance and operations funds. Such costs would be avoidable by a decision to buy; accordingly, analyses should consider these costs in addition to the added maintenance involved.

On the other hand, a decision to buy something now being made also introduces capital expense considerations, if equipment can be retired as a consequence. Provided the equipment can be usefully

allocated to other purposes, a relevant investment cost is avoided. While the "sunk" cost of equipment with no alternate use would be irrelevant, the reduction of bureau controlled equipment allowances permits the avoidance of future and relevant replacement costs.

Policy and review. The volume of potential make-or-buy decisions confronting a public works organization necessarily leads to attempts to routinize their processing, and local policies evolve. Approximately 42.7 per cent of the organizations responding indicated local policies existed which influenced make-or-buy decisions. For the greater part these were informal or unwritten policies.

Local policies supporting directives of higher authority, as in the instance of overseas purchases, essentially do not influence make-or-buy decisions. Rather the decision in such cases is to comply with the directive or face the consequences. Other policies, such as those which prohibit the fabrication of furniture, tend to express the obvious. This type would likely not exist were it not for the propensity of local target holders to "conserve" their material monies, at the expense of public works maintenance funds and station allotments, by generating work requests in lieu of appropriate requisitions.

Between these extremes is a range for the formulation and emergence of significant make-or-buy policies-- significant because in their absence determinations would be deliberative rather than automatic.

New products are continuously introduced on the market, local circumstances change, and the passage of time introduces new contingencies. Last year's decision may not be correct under the conditions prevailing today, and make-or-buy policies should be periodically reviewed. Further, the line between policy and custom is frequently obscure. Of equal importance is the assurance that invalid premises do not serve as precedents.

Who decides. The inherent peril in any decision is the possibility of overlooking relevant considerations, but to restrict make-or-buy decision-making to those organizational levels which are cognizant of all side effects and where all costs are controllable is manifestly impracticable, if not impossible. Cost implications and other consequences consistently cut across departmental, and even command, organizational lines.

Further, the number of potential make-or-buy decisions which must be handled in the normal course of public works operations requires their systematic disposition. It is expedient that make-or-buy decision-making be integrated with work input processing procedures. For these practical reasons, authority delegations should generally parallel work-authorization authority delegation.

It is considered advisable, however, that this authority be explicitly stated rather than left to inference. Only 34.7 per cent of the respondents explicitly did so. Work-authorization authority is conventionally delegated

in ranges of estimated cost-- estimated accounting cost if job order estimating techniques are used. The unique issues at stake in make-or-buy decisions may recommend exceptional handling for apparently insignificant outlays. A decision to buy an item now being made or to initiate making an item presently purchased, for example, could require higher management review because of the volume and long-run implications.

Since job order estimates are attuned to accounting purposes, precedent-setting and other significant make-or-buy decisions will require preliminary analyses of relevant costs prior to the preparation of work-authorization documents.

CHAPTER V

SUMMARY AND CONCLUSIONS

> In a very real sense, the correct answer to the question: "Which is preferable, make or buy?" is "It depends upon the circumstances."[1]

I. SUMMARY

As stated in the beginning, the purpose of this paper was to determine what factors influenced public works decisions to make or buy material components used by maintenance forces and, coincidentally, to evaluate the practices followed in arriving at these decisions. The make-or-buy literature searched was generally deficient for purposes of this study in two respects.

First was the matter of applicability to Navy public works organizations. The literature was oriented to the business world and in particular to industrial manufacturing. The former presented no especial problem in that improved input factor utilization and cost reduction possess appeal for government administrator and profit maximizer alike. Contrasts in production and service functions are more difficult to reconcile. The

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[1]James W. Culliton, Make or Buy (Boston: Harvard University, Graduate School of Business Administration, 1942), p. 98.

industrial concern exists to manufacture--its fundamental make-or-buy problem is to determine the best "mix" of things to make so that the remainder required in the final product may be bought. Manufacturing is an ancillary consideration for a public works organization. "In house" capacity to fabricate is primarily the by-product of a capability required to maintain--the basic make-or-buy problem is to determine if it is necessary to make at all. On balance, however, many considerations are identical in either context, and useful parallels may be drawn from others.

The second criticism that could be offered with respect to the literature is the matter of clarity. Writings were generally imprecise about the exact type of make-or-buy situation under discussion. Levine commented on this point and sought to remedy what he considered the resultant confusion.[2] In short, the question of applicability is also at the core of this deficiency, but in a more specific sense. Considerable care was required to identify appropriate arguments with particular circumstances.

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[2] Cf. ante p. 25.

II. CONCLUSIONS

The data obtained and presented in Section I, Chapter IV were considered to depict the factors influencing material component make-or-buy decisions in the public works organizations of the Naval Material Support Establishment. Since the entire population was sampled with 81.5 per cent participation, this conclusion was not predicated on a statistical test of significance.

Information obtained from the survey was further considered to support the conservative assumption, stated in Chapter I, that decisions sometimes include irrelevant or exclude relevant considerations. This conclusion, however, was based on a few isolated policies and practices noted among those reported. Other deductions, without resorting to generalization, were inhibited in that specific decisions could not be related to specific situations.

III. IMPLICATIONS

The large percentage of respondents reporting the inclusion of overhead prorations in comparative cost estimates and the questionable local practices cited in the analysis imply that make-or-buy decisions may be improved. Toward this end, it is suggested that guidelines be developed and disseminated among public works organizations. Ostensibly

such guidance could be incorporated with maintenance control program criteria. Inasmuch as the retention of local option is a requisite, guidance should be informative rather than directive in nature.

IV. RECOMMENDATIONS

Surveys are indispensible for studies of this subject; however, dependency upon questionnaires imposes decided limitations. Relevancy is the acid test in make-or-buy problems, and decisions cannot be properly evaluated unless all the constraints which influenced them are identifiable. Herein is the primary shortcoming of questionnaire use as experienced in this investigation of the subject. For this reason and the inexactitude noted in previous writings, it would be considered best that future research deal with specific cases. In this connection supplemental techniques, such as field visits and interviews, are recommended.

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APPENDIX

SURVEY QUESTIONNAIRE

QUESTIONNAIRE:
MAKE OR BUY DECISIONS IN PUBLIC WORKS ORGANIZATIONS
(PLEASE TYPE OR PRINT)

Information. This questionnaire is concerned with decisions to either fabricate or purchase material components utilized on job orders accomplished by Public Works Shops. A typical illustration is the decision to purchase or fabricate traffic control signs for installation by maintenance personnel. Determinations to accomplish repair, renovation, alteration or minor improvement projects by BUDOCKS contract versus station forces are not included in this survey.

1. (Activity) _____

2. Approximate FY 1964 expenditures for Public Works functions. _____(thousands). Average number of Maintenance Division/Department personnel on board . _____(civilian) _____(military)

3. Type of official accounting employed. (Check one)

☐ NIF ☐ APPROPRIATION ☐ OTHER (Specify) _____

4. Is costing on a "standard cost" basis? ☐ YES ☐ NO

Relative to "make or buy" decisions:

5. Are the majority of decisions dictated by policies or directives which prohibit shop fabrication or encourage procurement? ☐ YES ☐ NO

6. Rank in order of dominance (1 through 6) factors which most frequently influence decisions to "make.":

☐ NO SOURCE OF SUPPLY ☐ COMPARATIVE COSTS

☐ WORK LOAD OR CAPABILITY ☐ QUALITY

☐ PROCUREMENT LEAD TIME ☐ OTHER (Specify) _____

When costs are a determining factor:

7. Are formal comparative cost estimates developed? ☐ YES ☐ NO

8. Do "make" decisions ever require (check as appropriate)

- [ ] INCREASED EQUIPMENT ALLOWANCES?
- [ ] ADDITIONAL OR SPECIAL PURPOSE TOOLS?
- [ ] SHOP REARRANGEMENT?
- [ ] OTHER (Specify) _____
- [ ] NONE

9. In addition to direct civilian labor and material, do comparative estimates to "make" include allocations of such costs as:

Supervision?	[ ] YES	[ ] NO
Leave?	[ ] YES	[ ] NO
Administrative expenses?	[ ] YES	[ ] NO
Shop equipment maintenance?	[ ] YES	[ ] NO
Shop facility maintenance?	[ ] YES	[ ] NO
Direct military labor?	[ ] YES	[ ] NO
Other (Specify)		
_____	[ ] YES	
_____	[ ] YES	

10. In addition to purchase or stock price, do estimates to "buy" include allocations for costs such as:

Transportation?	[ ] YES	[ ] NO
Procurement administrative expense?	[ ] YES	[ ] NO
Storage costs (if stocked)?	[ ] YES	[ ] NO
Other (Specify)		
_____	[ ] YES	
_____	[ ] YES	

When procurement lead time is a determining factor:

11. For recurring requirements of procurable non-standard stock items, does the Supply Department

Stock?	☐ YES	☐ NO
Buy with imprest funds?	☐ YES	☐ NO
Arrange for blanket purchase order?	☐ YES	☐ NO

12. Decisions to "make" are generated by the absence of such arrangements (Check one):

☐ NEVER ☐ RARELY ☐ OCCASIONALLY ☐ FREQUENTLY

Incidental to the preparation of "make or buy" comparative cost estimates:

13. Are EPS utilized as the basis for "make" estimates? ☐ YES ☐ NO

14. Is historical cost information readily available from the official accounting system for comparative cost estimates? ☐ YES ☐ NO

15. If answer to question 14 is yes, is the information suitable for purposes of preparing comparative cost estimates? ☐ YES ☐ NO

16. Comparative cost estimates are generally preapred by (specify organizational component or title) _____

Authorization to make "make or buy" decisions:

17. Estimate analysis and final determination is generally made by (specify organizational title) _____

18. Is authority for make or buy decisions explicitly included in delegation of job order authorization authority? ☐ YES ☐ NO

19. Is a locally formulated policy existent which influences make or buy decisions? ☐ YES ☐ NO

20. If answer to question 19 is yes, please attach a copy or briefly summarize informal policy in the space below:

21. Please furnish any comments or additional information which you desire or consider pertinent in the space below:

_____ (DATE)

_____ (SIGNATURE AND TITLE)

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